INVESTIGATION OF THE HIGH-TEMPERATURE BEHAVIOR OF COAL ASH IN REDUCING AND OXIDIZING ATMOSPHERES. G. P. Huffman, F. E. Huggins and G. R. Dunmyre. U. S. Steel Corp., Research Laboratory, Monroeville, Pennsylvania 15146.

Ash samples from a large suite of coals were quenched from high temperatures under either a reducing (60% CO/40% CO_2) or an oxidizing (air) atmosphere, and investigated by Mossbauer spectroscopy, scanning electron microscopy/automatic-image-analysis, and X-ray diffraction. Significant partial melting of the ashes occurred at temperatures as low as 200 to 400°C below the initial deformation temperature (IDT) defined by the ASTM ash fusion test. Under reducing conditions, melting is normally controlled by the iron-rich corner of the FeO-Al_2O_3-SiO_2 phase diagram, as evidenced by the observation of such phases as wustite (FeO), fayalite (Fe_2SiO_4), hercynite ($FeAl_2O_4$), and ferrous glass in samples quenched from 900 to 1200°C. The percentage of glass increases rapidly between 900 and 1100°C, approaching 70 to 100% above approximately 1200°C. Ashes rich in CaS are an exception to this rule, exhibiting copious formation of iron sulfide and melting behavior associated with the FeO-FeS phase diagram. Under oxidizing conditions, the percentage of glass in samples quenched from below 1100 to 1200°C is proportional to the amount of the potassium-bearing mineral illite in the coal. Above 1200°C, calcium and to a lesser extent, iron, become effective fluxes; melting accelerates between 1200 and 1400°C and nears completion between 1400 and 1500°C for most ashes.